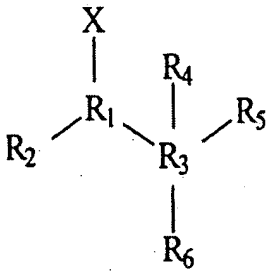
Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (previously presented): A composition for performing a polynucleotide replication reaction, which comprises a buffer, one or more template polynucleotides, nucleotide triphosphates, one or more polymerase enzymes or fragments thereof, and one or more reaction adjuvants comprising compounds of the formula:



Formula I

wherein:

R_1 is C or S; and

when R_1 is C, X is =O, R_3 is N and R_6 is absent;

when R_1 is S, X is =O or 

and R_3 is C;

R_2 is H or CH_3 only when one or more of R_4, R_5 and R_6 is not H, and otherwise R_2 is an unsubstituted or halogen-, hydroxyl- or alkoxy- substituted alkyl or cycloalkyl of length m, wherein m is selected such that the total number of carbons in the compound is between 3 and 8 when R_1 is C and between 2 and 8 when R_1 is S; wherein any two of R_2,

R_3, R_4, R_5 and R_6 can form a cyclic structure in which cyclization is effected through a bond between them; and

R_4, R_5 and R_6 each is H, alkyl, cycloalkyl, halogen-, hydroxyl or alkoxy- substituted alkyl or cycloalkyl of length n, wherein n is selected such that the total number of carbons in the compound is between 3 and 8 when R_1 is C and between 2 and 8 when R_1 is S.

2. (previously presented): The composition of claim 1, wherein the reaction adjuvant comprises a cyclic compound, wherein the cyclization is effected through a bond between any two of R_2, R_3, R_4, R_5 and R_6.

3. (previously presented): The composition of claim 2, wherein the cyclic portion of the compound comprises five, six, or seven members.

4 (cancelled).

5. (previously presented): The composition of claim 3, wherein R_1 is S and remainder of the compound is unsubstituted.

6-14 (cancelled).

15. (previously presented): The composition of claim 1, wherein the reaction adjuvant comprises a compound in which R_1 is S, X is =O or and R_3 is C.

16. (previously presented): The composition of claim 15, wherein the compound is cyclic.

17. (previously presented): The composition of claim 16, wherein the cyclic structure of the compound is a five, six, or seven-membered ring formed by a bond between R_2 and either R_4, R_5 or R_6.

18. (previously presented): The composition of claim 17, wherein the ring is unsubstituted except in R_1.

19. (previously presented): The composition of claim 18, wherein the compound is selected from the group consisting of tetramethylene sulfone and tetramethylene sulfoxide.

20. (previously presented): The composition of claim 15, wherein the compound is acyclic.

21. (previously presented): The composition of claim 20, comprising a compound in which R_2 or R_3 is lower alkyl or substituted lower alkyl.

22. (previously presented): The composition of claim 21, wherein the compound is selected from group consisting of methyl sulfone, ethyl sulfone, n-propyl sulfone, n-propyl sulfoxide and methyl sec-butyl sulfoxide.

23. (previously presented): The composition of claim 1, wherein the polynucleotide reaction is an amplification reaction.

24. (previously presented): The composition of claim 23, wherein the amplification reaction is selected from the group consisting of polymerase chain reaction, nucleic acid sequence-based amplification, transcription-based amplification system, self-sustained sequence replication, ligation amplification reaction, Q beta replicase amplification and ligase chain reaction.

25. (previously presented): The composition of claim 1, wherein the one or more polymerases or fragments thereof is selected from the group consisting of Taq polymerase, Tth polymerase, Tme polymerase, Tli polymerase, Pfu Polymerase, DNA polymerase I, Klenow fragment and reverse transcriptase.

26. (previously presented): The composition of claim 15, wherein the reaction adjuvant has a potency of at least 75% of the potency of DMSO or formamide in an equivalent polynucleotide chain reaction (PCR).

27. (previously presented): The composition of claim 1, wherein the reaction adjuvant has a specificity of at least 80% of the specificity of DMSO or formamide in an equivalent polynucleotide chain reaction (PCR).

28. (previously presented): The composition of claim 1, wherein the reaction adjuvant has an effective range spanning at least 0.1 M.

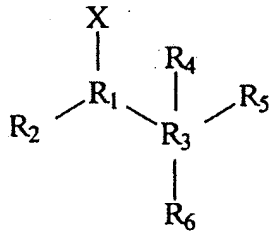
29. (previously presented): The composition of claim 1, wherein the polynucleotide template comprises greater than 50% G+C.

30. (previously presented): The composition of claim 1, wherein the one or more polymerase enzymes or fragments thereof is selected from the group consisting of Taq polymerase, Tth polymerase, Tme polymerase, Tli polymerase, Pfu polymerase, DNA polymerase I, Klenow fragment and reverse transcriptase.

31-59 (cancelled)

60. (previously presented): A kit for performing a polynucleotide reaction, comprising a container that includes:

a) one or more compounds of the formula:



Formula I

wherein:

R_1 is C or S; and

when R_1 is C, X is =O, R_3 is N and R_6 is absent;

when R_1 is S, X is =O or 

and R_3 is C;

R_2 is H or CH_3 only when one or more of R_4, R_5 and R_6 is not H, and otherwise R_2 is an unsubstituted or halogen-, hydroxyl- or alkoxy- substituted alkyl or cycloalkyl of length m, wherein m is selected such that the total number of carbons in the compound is between 3 and 8 when R_1 is C and between 2 and 8 when R_1 is S; wherein any two of R_2, R_3, R_4, R_5 and R_6 can form a cyclic structure in which cyclization is effected through a bond between them; and

R_4, R_5 and R_6 each is H, alkyl, cycloalkyl, halogen-, hydroxyl or alkoxy- substituted alkyl or cycloalkyl of length n, wherein n is selected such that the total number of carbons in the compound is between 3 and 8 when R_1 is C and between 2 and 8 when R_1 is S; and

b) instructions for using the one or more compounds in a polynucleotide replication reaction.

61. (previously presented): The kit of claim 60, which further comprises one or more of:

a) a polynucleotide replication reaction buffer;

b) nucleotide triphosphates;

c) oligonucleotide primers;

d) a known template polynucleotide for use as a control; and

e) one or more polymerase enzymes.

62. (previously presented): The kit of claim 61, customized for performing amplification reactions.

63. (previously presented): The kit of claim 62, customized for performing PCR

64-66 (cancelled)

67. (previously presented): A kit for performing the method of claim 64, which comprises a container in which is included:

a) the plurality of reaction adjuvants; and

b) instructions for using the reaction adjuvants to optimize polynucleotide replication of a selected template polynucleotide.

68. (previously presented): The kit of claim 67, which further comprises one or more of:

a) a polynucleotide replication reaction buffer;

b) nucleotide triphosphates;

c) oligonucleotide primers;

d) a known template polynucleotide for use as a control;

e) one or more polymerase enzymes; and

f) one or more reaction vessels for performing the plurality of polynucleotide replication reactions.

69. (previously presented): The kit of claim 68, customized for performing amplification reactions.

70. (previously presented): The kit of claim 69, customized for performing PCR.

71. (new): The composition of claim 22, wherein the reaction adjuvant has a potency of at least 75% of the potency of DMSO or formamide in an equivalent polynucleotide chain reaction (PCR);

wherein the reaction adjuvant has a specificity of at least 80% of the specificity of DMSO or formamide in an equivalent polynucleotide chain reaction (PCR); and

wherein the reaction adjuvant has an effective range spanning at least 0.1 M.

72. (new): The composition of claim 24, wherein the compound is tetramethylene sulfoxide.

73. (new): The composition of claim 1, wherein the one or more polymerases or fragments thereof is selected from the group consisting of Taq polymerase, Tme polymerase, Pfu Polymerase, DNA polymerase I, Klenow fragment and reverse transcriptase.

74. (new): The composition of claim 1, wherein the one or more polymerase enzymes or fragments thereof is selected from the group consisting of Taq polymerase, Tme polymerase, Pfu polymerase, DNA polymerase I, Klenow fragment and reverse transcriptase.